



Australian Government

Department of Infrastructure and Regional Development

Bureau of Infrastructure, Transport and Regional Economics



The impact of airbags and electronic stability control on Australian light vehicle fatalities

At a glance

- This Information Sheet presents estimates of the impact of airbags and electronic stability control (ESC) on fatalities in light vehicle crashes.
- It is estimated that frontal airbags have reduced light vehicle fatalities by 13 per cent, side airbags have reduced light vehicle fatalities by 4 per cent, and that ESC has reduced light vehicle fatalities by 6 per cent. Together, these measures are estimated to have reduced light vehicle fatalities by 23 per cent.
- This may account for the equivalent of around half the reduction in the fatality rate, per kilometre travelled, since 2007.
- The impacts of side airbags and ESC will increase as newer vehicles filter through the fleet.

Introduction

From 1990 to 2014, the number of road fatalities in Australia halved (BITRE 2015, BITRE 2014a), and the fatality rate per vehicle kilometre fell by two thirds from 1990 to 2012 (BITRE 2014b). This is attributable to a number of factors, including safer vehicles, safer roads, and improved law enforcement. To some extent there are likely to be offsetting factors, particularly increased driver distraction (BITRE 2010).

While BITRE (2010) estimated the impacts of seatbelts, speed cameras, and random breath tests, this paper estimates the impacts of two more recent measures: airbags and ESC. Rather than using regression analysis as was done for BITRE (2010), this paper draws on other empirical estimates of the impacts on crashes of particular types, and estimates of the proportion of fatal accidents that are of these types. These are combined with estimates of the number of light vehicles equipped with these technologies each year. These standard feature estimates are based on matching vehicle information from Glass's Research Data (Glass's Information Services, 2014) with new light passenger vehicle sales figures from various VFACTS issues (FCAI, various issue). The ABS Motor Vehicle Census (ABS 2014) is used to estimate the proportion of the fleet made up by such vehicles.

These technologies are expected to have a further impact in the future, as newer vehicles continue to displace older vehicles in the vehicle fleet. Projections of the likely impacts of side airbags, ESC, and autonomous emergency braking are included in BITRE 2014c.

Airbags

Frontal airbags began to be introduced as a standard feature in light vehicles in around 1990, and by 2006 were a standard feature in over 90 per cent of new light vehicles. Take-up of passenger airbags was slower than driver airbags—by 2014, around 80 per cent of the light vehicle fleet was equipped with driver airbags, but only around 55 per cent with passenger airbags. Frontal airbags are most effective at reducing trauma in

front-impact crashes. Paine (2002), drawing on estimates by Langwieder et al (1998) and MUARC (1992), assumed that driver airbags reduced fatalities by 25 per cent in front-impact crashes, and that passenger airbags reduced fatalities by 20 per cent in frontal crashes in which a passenger was involved.

Side airbags began to be introduced as a standard feature in around 1995 (D'Elia et al 2012). By 2014 over 75 per cent of new light vehicles were equipped, and 36 per cent of the light vehicle fleet. Side airbags are most effective at reducing trauma in side-impact crashes, which account for approximately 20 per cent of fatalities in Australia (UN 2013). D'Elia et al (2012), analysing side impact crashes, found that combination airbags were associated with a reduction of 51 per cent in the odds of death and injury to all body regions.

Safety outcomes in frontal and side impact crashes have also been improved through other vehicle occupant protection countermeasures used to meet performance based standards/tests including Australian Design Rules 69 (Full Frontal Impact Occupant Protection), 72 (Dynamic Side Impact Occupant Protection) and 73 (Offset Frontal Impact Occupant Protection). The impacts of these measures have not been estimated here.

Electronic stability control

ESC involves an on-board computer detecting when loss of control is imminent then restoring control through reducing power and applying individual braking to each wheel (FCAI 2015). ESC began to be included as a standard feature in vehicles sold in Australia in around 1999, and by 2014 nearly all new light vehicles were equipped with ESC. ESC was mandated for all new passenger cars in 2013 (FCAI 2015) and will be mandated for all new light commercial vehicles in 2017 (DPMC 2013). It is estimated that around 29 per cent of the light vehicle fleet was equipped with a form of ESC in 2014.

ESC is most effective at reducing single-vehicle crashes, particularly 'run-off-road' crashes, in which a vehicle leaves the roadway. Single-vehicle crashes accounted for 47 per cent of Australian road fatalities in 2013 (BITRE 2014a) and BITRE estimates that run-off-road crashes accounted for 38 per cent of road fatalities in 2008-2012 (BITRE 2014c).

Scully et. al. (2007) cite international findings that fatal single vehicle (car) crashes are reduced by 53 per cent by ESC, and that run-off-road crashes are reduced by 54.5 per cent. For this analysis, BITRE assumed a 53 per cent reduction in fatalities from run-off-road crashes.

Note that as airbags reduce the fatality risk in some of the crashes that will be avoided by ESC, meaning that the impact of ESC on fatalities will be slightly lower than it would be in the absence of airbags. This effect has not been taken into account in this analysis, but could potentially reduce the estimate of the impact of ESC alone by up to 0.7 percentage points.

Summary of findings

Airbags and ESC are estimated to have reduced the fatality rate per kilometre travelled by 23 per cent, relative to a base case without these technologies. This is equivalent to around half the observed decline since 2007.

Table 1 summarises the assumptions used, the estimates of uptake, and the resulting reduction in fatality risk.

Figure 1 shows the uptake of airbags and ESC, from 1990 to 2014. Figure 2 shows the estimated proportional reduction in fatalities from airbags and ESC from 1990 to 2014. Figure 3 shows the fatality rate from 1990 to 2014, and includes the predicted contributions of earlier measures considered by BITRE (2010): seatbelts, random breath testing, and speed cameras.

In total, airbags and ESC, combined with the continuing impacts of random breath testing and speed cameras, can account for much of the observed reduction in the fatality rate since 1990. However, reductions in the fatality rate could also be driven by infrastructure improvements, speed limit reductions, improved enforcement, or other vehicle improvements. The impacts of a range of measures are discussed in BITRE 2014c. As discussed in BITRE 2010, some of these reductions may have been offset by increases in distraction due to mobile devices. While over the long term the actual fatality rate has fallen by roughly the same proportion as predicted by this analysis, in some years it has fallen faster and in others slower.

Table I Summary of assumptions and estimates

Technology	Relevant crash types	Proportion of deaths accounted for by relevant crash types	Reduction in fatality risk in relevant crashes (per cent)	Overall reduction in fatality risk for equipped vehicles (per cent)	Proportion of light vehicle fleet with technology in 2014 (per cent)	Estimated fatality reduction in 2014 (per cent)
Driver airbags	Front impact	60 ^a	25 ^a	15	79	12
Passenger airbags	Front impact with passenger	12 ^a	20 ^a	2	55	1
Side airbags	Side impact	20 ^b	51 ^c	10	36	4
ESC	Run-off-road	38 ^d	53 ^e	20	29	6

a Paine 2002, citing Langwieder et al (1998) and MUARC (1992)

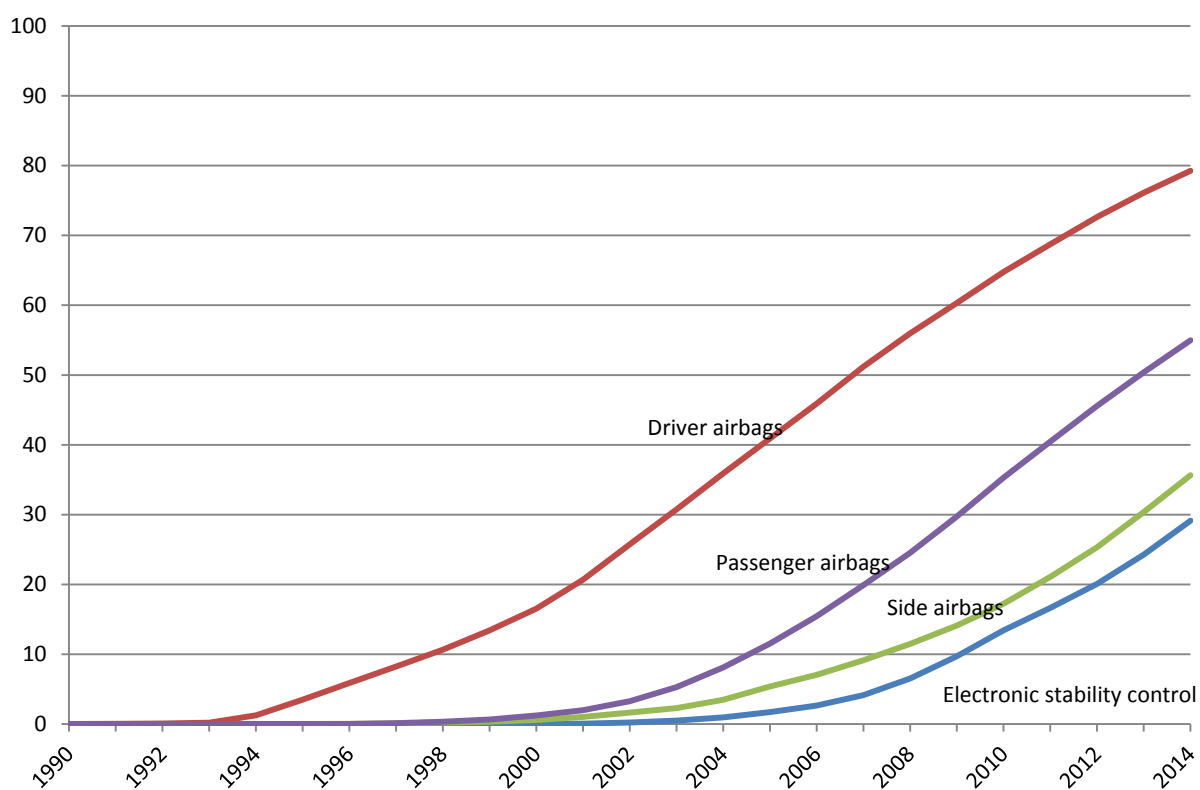
b United Nations 2013

c D'Elia, Scully and Newstead 2012

d BITRE unpublished data

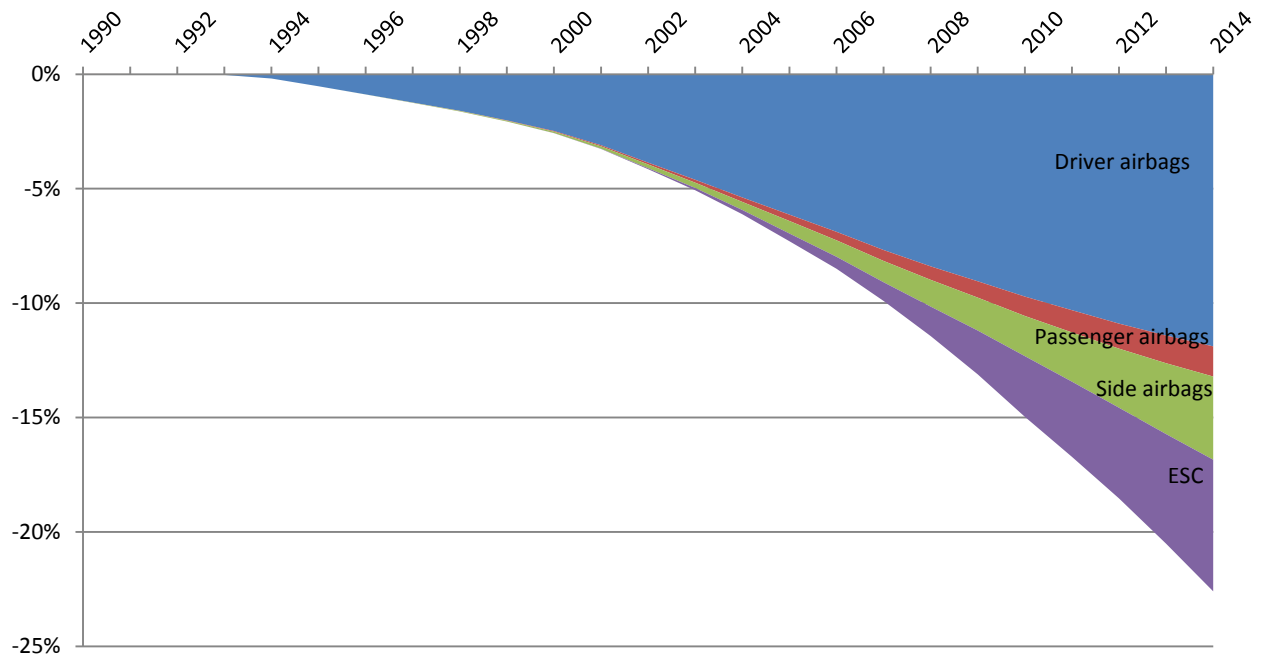
e Scully and Newstead 2007, citing US research

Figure I Proportion of light vehicle fleet with airbags and electronic stability control



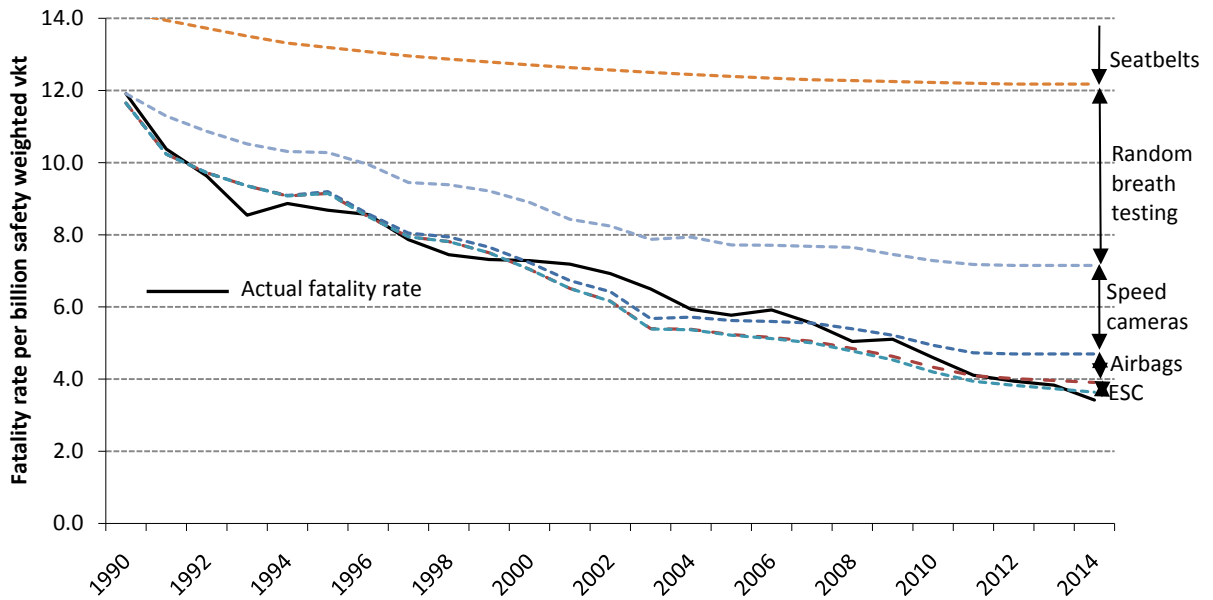
Source BITRE estimates derived from VFACTS (various years) Glass's (2014), ABS (2014)

Figure 2 Estimated proportional impacts of selected measures on fatalities



Sources BITRE analysis

Figure 3 Estimated impacts of measures on fatalities per billion safety weighted vehicle kilometres travelled^{a,b}



a 'Safety-weighted' vehicle kilometres account for changes in traffic composition, by converting vehicle kilometres to light vehicle equivalent units. See BITRE (2014).

b This analysis has not attempted to fully explain for changes in fatality rates. Factors that have not been modelled include infrastructure improvements, changes in speed limits and enforcement, other vehicle improvements and distraction.

Sources BITRE 2014b, BITRE analysis

References

- Australian Bureau of Statistics (ABS) 2014, [Motor Vehicle Census, Australia, 31 Jan 2014](#), Cat. No. 9309.0, released July 30.
- Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2010, [Effectiveness of measures to reduce road fatality rate](#), Information Sheet 39, BITRE, Canberra.
- Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2014a, [Road deaths Australia, 2013 Statistical Summary](#), BITRE, Canberra ACT
- Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2014b, [Road Safety – Modelling a Global Phenomenon, Report 141](#) Canberra ACT
- Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2014c, [Impact of road trauma and measures to improve outcomes](#), Report 140, December, Canberra
- Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2015, [Road deaths Australia, December 2014](#), BITRE, Canberra ACT
- D’Elia, A., Scully, J. and Newstead, S. 2012, [Evaluation of vehicle side airbag effectiveness](#), Monash University Accident Research Centre, Melbourne.
- Department of the Prime Minister and Cabinet (DPMC) 2013, [Electronic Stability Control for Light Commercial Vehicles – Details-Stage Regulation Impact Statement – Department of Infrastructure and Regional Development](#), 26 November 2013 (accessed Jan. 2015).
- Federal Chamber of Automotive Industries (FCAI) 2015, [Electronic Stability Control](#) (accessed Jan. 2015).
- Glass’s Research Data (GRD), 2014, Glass’s Information Services.
- Langwieder, K., Hummel, T. and Anselm, D. 1998, [The effect of airbags to injuries and accident costs](#), Proceedings of the 16th International Technical Conference on the Enhanced Safety of Vehicles
- Monash University Accident Research Centre (MUARC) 1992, [Feasibility of occupant protection measures](#), for Federal Office of Road Safety
- Paine 2002, [Encouraging the purchase of safer vehicles – Part A: Benefits and costs of vehicle safety features](#), for Department for Planning and Infrastructure, Western Australia
- Scully, J. and Newstead, S. 2007, [Preliminary evaluation of electronic stability control effectiveness in Australasia](#), Monash University Accident Research Centre, Melbourne.
- United Nations 2013, [Addendum 14: Global technical regulation No. 14 – Global technical regulation on pole side impact](#), Geneva, Switzerland.
- VFACTS, Federal Chamber of Automotive Industries, various issues.

© Commonwealth of Australia 2015

ISSN 1440-9593

ISBN 978-1-922205-84-1

March 2015 / INFRA 2225

This information sheet was prepared by Jack McAuley, Mark Cregan and Tim Risbey. For further information on this publication please phone (02) 6274 7818 or email bitre@infrastructure.gov.au.

Creative Commons Attribution 3.0 Australia Licence is a standard form licence agreement that allows you to copy, communicate and adapt this publication provided that you attribute the work to the Commonwealth and abide by the other licence terms. A summary of the licence terms is available from <http://creativecommons.org/licenses/by/3.0/au/deed.en>.

The full licence terms are available from <http://creativecommons.org/licenses/by/3.0/au/legalcode>.

This publication should be attributed in the following way: Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2015, *The impact of side airbags and electronic stability control on Australian road fatalities*, Information Sheet 68, BITRE, Canberra.

Use of the Coat of Arms

The Department of the Prime Minister and Cabinet sets the terms under which the Coat of Arms is used. Please refer to the Department's Commonwealth Coat of Arms and Government Branding web page <http://www.dpmc.gov.au/guidelines/index.cfm#brand> and in particular, the Guidelines on the use of the Commonwealth Coat of Arms publication.

Contact us

This publication is available in PDF format. All other rights are reserved, including in relation to any Departmental logos or trademarks which may exist. For enquiries regarding the licence and any use of this publication, please contact:

Department of Infrastructure and Regional Development
Bureau of Infrastructure, Transport and Regional Economics (BITRE)
GPO Box 501, Canberra ACT 2601, Australia

Phone: (international) +61 2 6274 7210

Fax: (international) +61 2 6274 6855

Email: bitre@infrastructure.gov.au

Website: www.bitre.gov.au